Enhancing students' learning in laboratories through professional development of teaching assistants

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Outline

Overview of Australian education system

Laboratory classes

The professional development program

Evaluation

Conclusions

Australian Universities

44 Higher Education Institutions

1.2 million students (28% international)

109,000 staff (44% academic)

Universities are fairly independent

- Control their own budget
- Can start new courses, close courses
- Decide on staffing and distribution of funds

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General course structures

Bachelors degree 3 years

Honours 1 year

Graduate diploma 1 year

Masters degree (by coursework) 2 years

Masters degree (Research) ~2 years

PhD ~3.5 years

*exceptions: Melbourne Uni & UWA

University entrance requirements

- Prerequisites
  - Varies between universities / courses
- TER (tertiary entrance rank)
  - Normalised ranking for all students
    - TER = 95 means top 5% of students
  - Minimum TER set by university
    - Based on course demand and quota

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Australian Chemistry

32 Universities offer chemistry courses

A third have discrete Chemistry Departments

Others part of larger departments/schools

4 Unis offer Chemistry courses in Perth WA

Therefore significant competition

Competition for places based on:

student performance (TER) and quota

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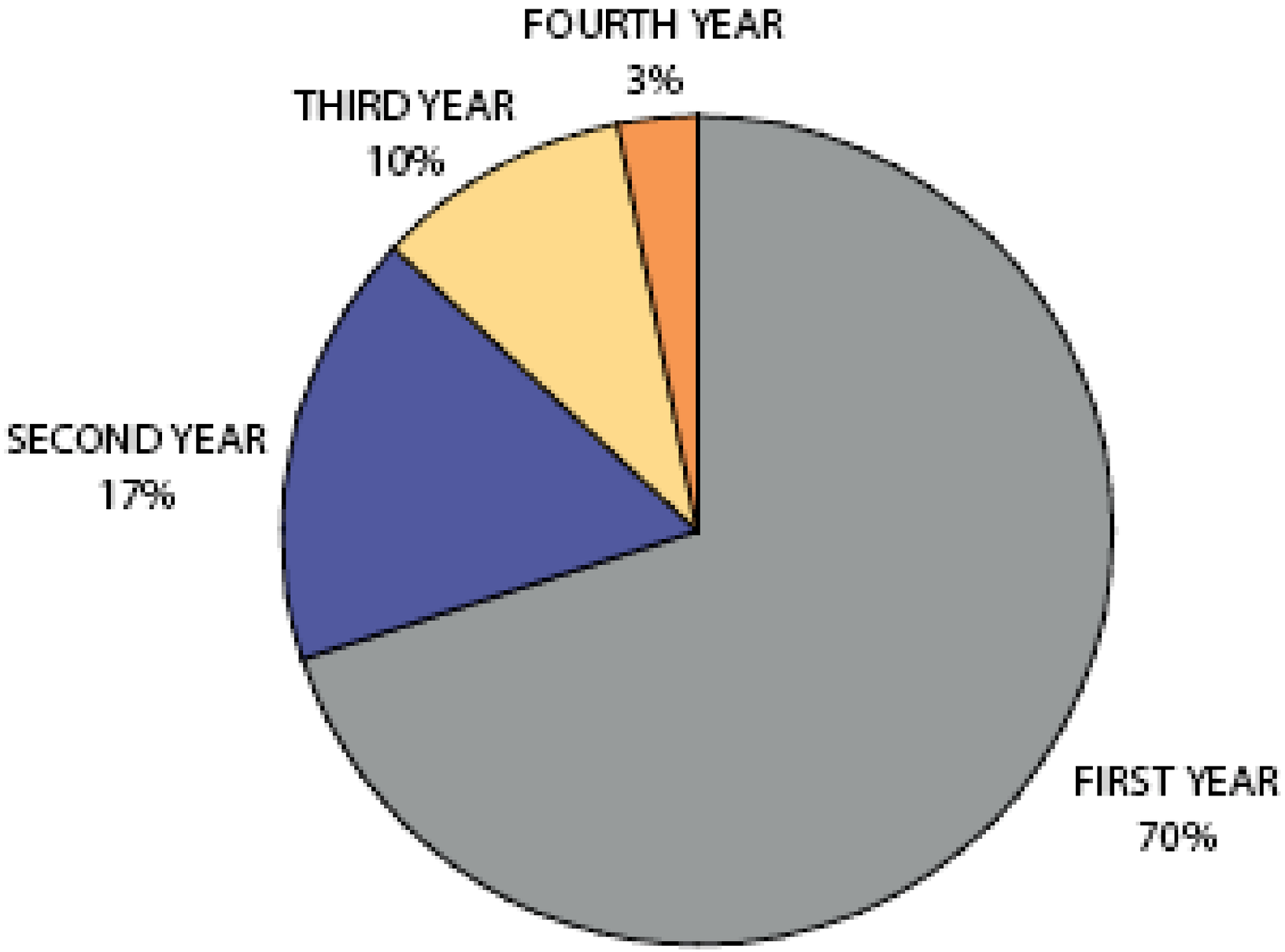
Australian Chemistry



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Current scenario at Curtin

Current scenario at Curtin

Over 1400 first year students

Half have no high school chem and weak maths

Weekly 3 hr lab class

- Mon – Fri: 8.30 am – 8.30 pm
- Sat 9 am – 12 noon

Wide range of student ability/interest

Decreasing academic staff members

Increased use of teaching assistants (demonstrators)

Current scenario at Curtin

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Typical teaching assistants

Lab TA called demonstrators

Are undertaking post-graduate study.

Have never taught before.

Have received little or no instruction in teaching methods.

Purpose for teaching is often financial or is required by the school.

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Laboratory Classes

Unique feature of science courses.

Expensive to run and maintain.

Mixture of practical activities and theory.

Large amount of other distracting information.

Learning value sometimes questionable.

Laboratory Classes

How can we maximise the learning opportunities in labs?

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Possible strategies

Improve quality of instruction

Improve student engagement

Improve experiments (ASELL) (asell.org)

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Improving the teaching

Helping teaching assistants teach better

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Possible TA issues to consider

May teach the way they were taught

Belief that “what worked for them” will work for their students

Have a strong interest in the subject and possibly unable to relate to someone who is not

Likely to be a high achiever, therefore their assessment of student work may be unrealistic.

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Inexperienced demonstrators
+
Inexperienced students
=

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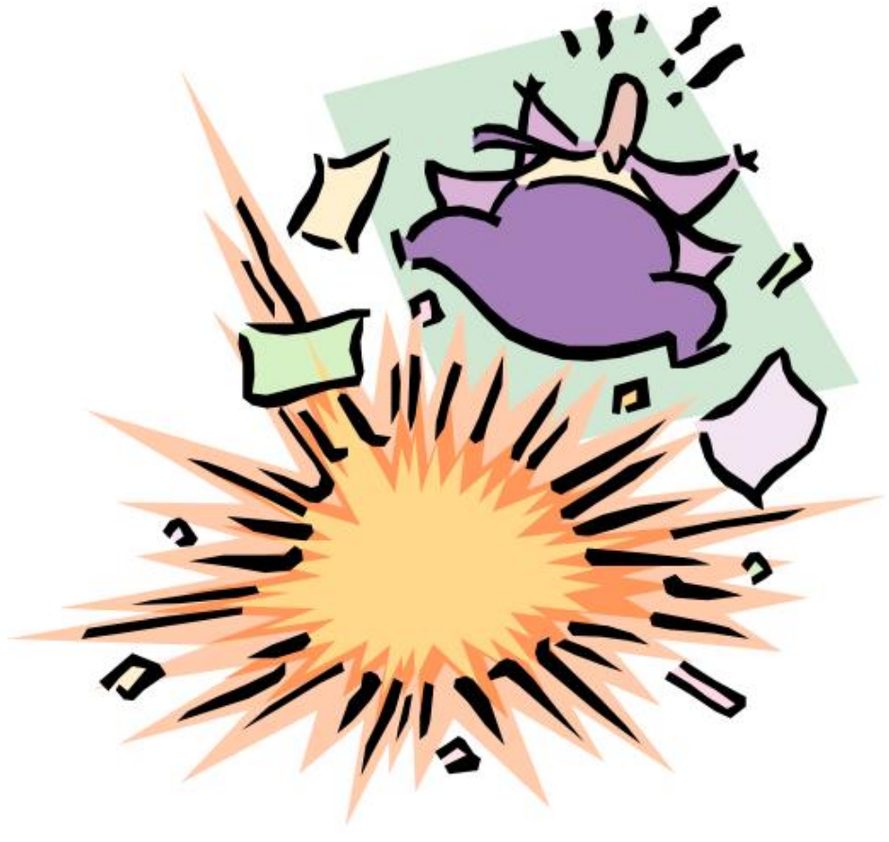

So ...

how should we prepare our demonstrators?

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Curtin’s 4 point approach

Laboratory Demonstrators’ Workshop

Demonstrator’s “Contract”

Preparation Template

Weekly demonstrators meeting

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Lab Demonstrators' Workshop

Free full day workshop - discussion based

Compulsory for all new chemistry demonstrators

Workshop program

Why have labs?

What is your role?

Quality of good/bad demonstrators

Student expectations of demonstrators

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Lab Demonstrators' Workshop

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Lab Demonstrators' Workshop

Workshop program (cont.)

How students learn and what helps or hinders learning

Part 1 - Understanding learning and teaching: An information processing model (Johnstone).

Part 2 - *A private universe*; deep and surface learning; effective questioning

Laboratory scenarios

Marking and giving feedback.

Workshop activity - info processing

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Lab Demonstrators' Workshop

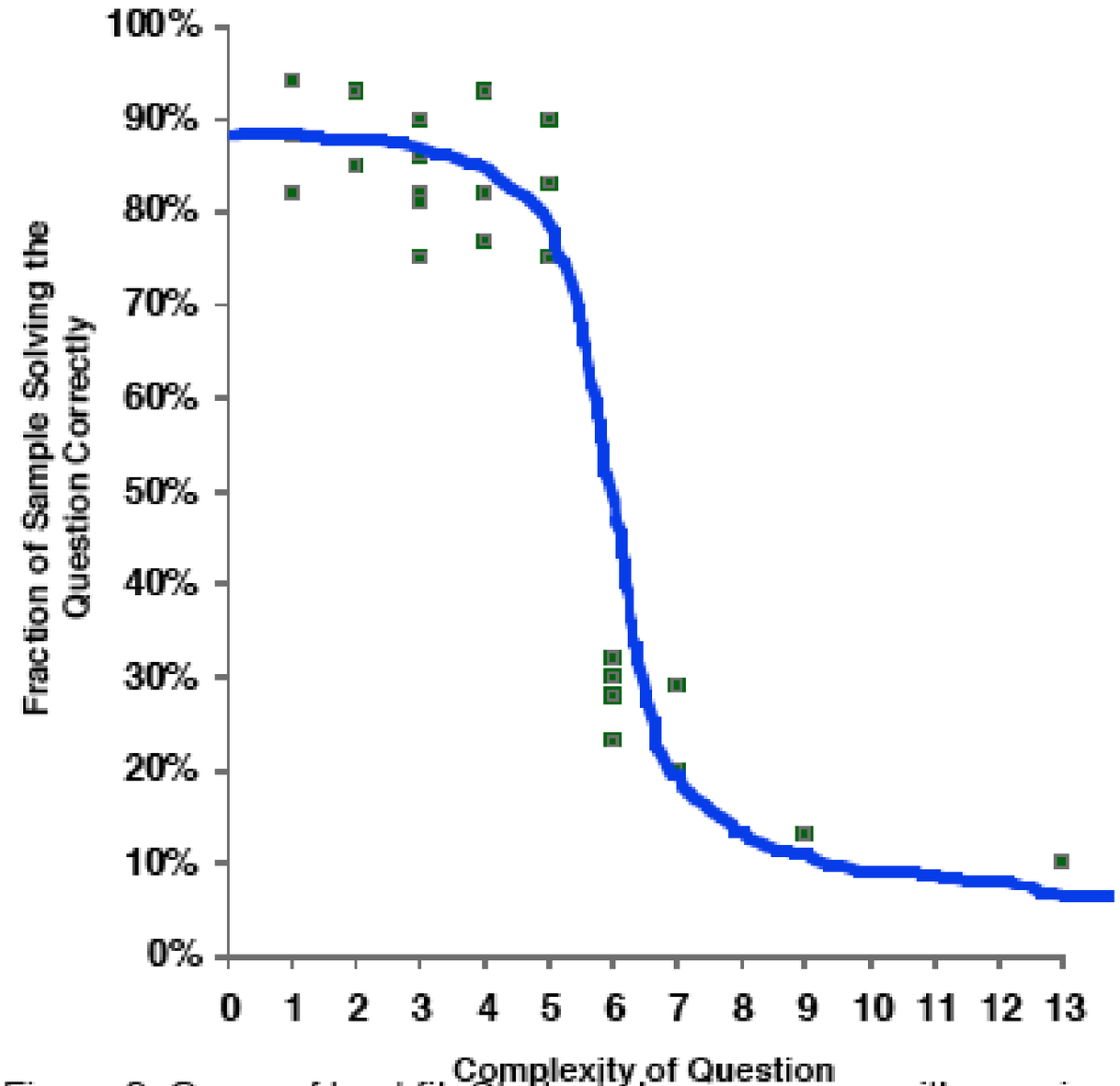

Figure 3. Curve of best fit. Students have success with a series of questions of increasing complexity until a certain point, after which most students fail.

A.H. Johnstone, *J. Chem. Educ.*, 1997, **74**, 262.

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Demonstrator’s “Contract”

Outlines what is expected of them including:

- Preparation requirements
- Time availability
- Attitude
- Assessment process
- Payment process
- Policies and administration

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Preparation Template

Demonstrators are provided with a template to help them prepare for their lab class

The topic headings include:

- Learning objectives of the lab class
- New procedures to be learned by students
- New equipment to be used by students
- Key calculations/equations used in this exercise
- Answers to assigned questions

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Preparation Template

The topic headings (Continued):

Possible questions to probe understanding

Risk assessment

Queries/Concerns that I need to follow up:

Lesson plan of laboratory exercise.

Feedback to the coordinator:

•Laboratory Exercise – ¶

•Demonstrator: → → → → → → ··Date: ¶

•1. → What are the purposes of this exercise for students? ↵
What will they learn? ¶

•→ ¶
•→ ¶
•→ ¶
•→ ¶

•2. →New procedures to be learned by students are: ¶

•→ ¶
•→ ¶
•→ ¶

• → Potential pitfalls/warnings on procedures: ¶

¶
¶
¶

•3. →New equipment to be used by students and special instructions required: ¶

•→ ¶
•→ ¶
•→ ¶

•4. →Key calculations/equations used in this exercise: (provide worked example) ¶

¶
¶
¶
¶

•5. →Possible questions to probe student understanding: ¶

1.¶

Weekly meeting

Meeting Agenda

Review last week’s labs

- Problems / Accidents
- Possible improvements

Preview this week’s labs

- Work through the preparation template
- Discuss possible difficulties associated with the experiment

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Project outcomes

Project commenced at Curtin in 2001

Workshops run at Curtin annually

Workshops also run in 11 other institutions

Over 950 workshop participants since 2001

5 workshops dedicated to laboratory coordinators

Feeback very positive

National teaching award in 2013

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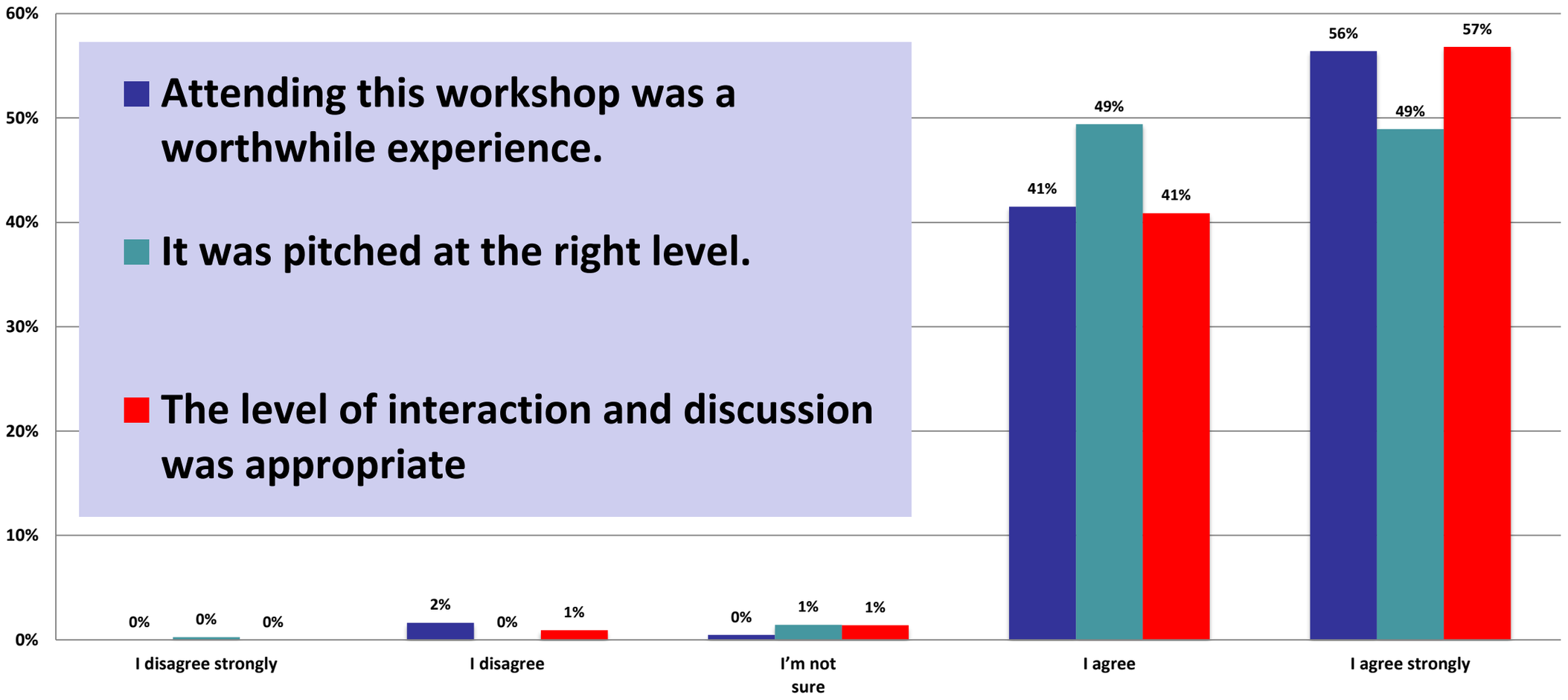
Project outcomes

Participant evaluation of workshops



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Outcomes – Participant Quotes

Overall the W/S is very good. It must also be made compulsory for all laboratory class coordinators. This W/S was greatly motivating, eye-opener in the various methods of teaching assessing in the lab class. Well done! (Lab coordinator)

The main thing after this workshop is to recognise the importance of demonstrators and the way to communicate with them (Lab coordinator)

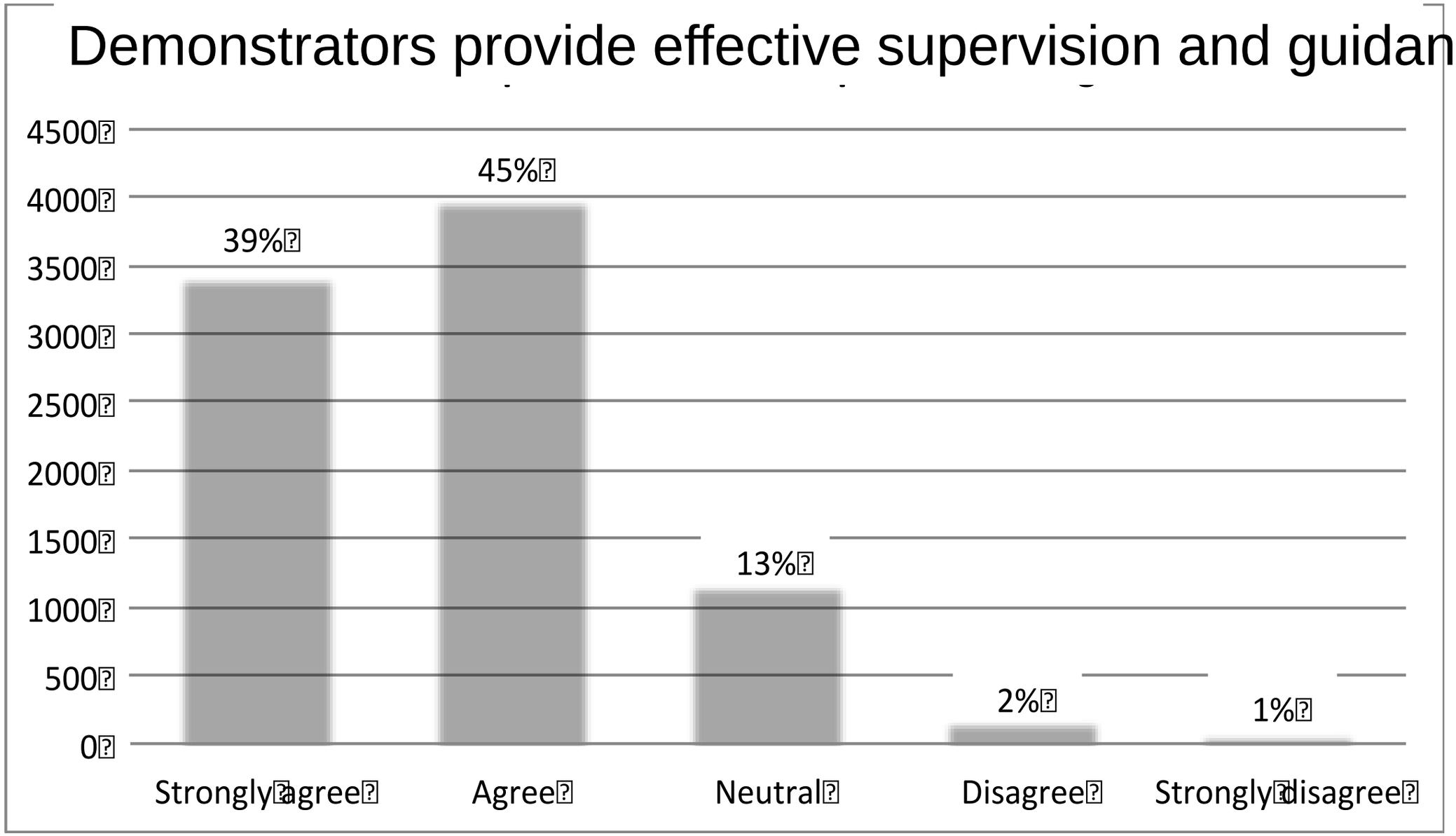
Outcomes – Participant Quotes

My outlook on teaching has improved, and have become a more prepared and confident person to teach.

Meetings were a good place for people with a range of experience in a lab to come together and share their knowledge

It made us think and not to assume things we sometimes feel we know, but we have to be certain

Student feedback



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“ Every skilled craft provides formal instruction and/or mentorship for its new practitioners ... except college teaching, which expects its newcomers to learn everything themselves by trial-and-error.”

(Stice *et al*, 2000)

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